Streaming and sound localization with a preceding distractor

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1. ABSTRACT

A previous study of sound localization with a preceding distractor showed that (1) the distractor affects response bias and response variance for the target, and (2) the effect is mediated by an adaptation mechanism. This study was the first one to demonstrate that the distractor even when presented during control trials in which the target was presented alone (Andrejková et al., 2017). Neural mechanisms operating on new cues of location-related information are likely to cause such effects. The current study examined the perceptual consequences of target localization performance. Localized sound was examined for 2 click-trial stimuli. A click at the target was presented with a distractor click to be grouped with the target click. Those trials were analyzed in the same fashion as trials in which both clicks were presented with an adapting sound. As hypothesized, the click-distractor affected target localization more than the distractor click. On the other hand, the biases in the control trials were greater for the distractor click. These results indicate that performance is influenced by both top-down mechanisms like streaming and bottom-up mechanisms like stimulus-driven acoustic adaptation.

2. CURRENT STUDY

To replicate results of Kopčo et al. (2007), add a condition in which the original (click) distractor is replaced by an 8-click distractor expected to induce streaming. Hypothesis: HLS. Effects of distractor in Kopčo et al. (2007) were mainly due to grouping of distractor and target. Therefore, streaming in the current study will reduce the response biases and variance due to the distractor. HLS. Contextual biases in Kopčo et al. (2007) were mainly due to set-up mechanism sensitive to stimulus distribution. Therefore, the 8-click distractor will cause larger biases since it changes the stimulus distribution even more.

3. METHODS


tabular_data

4. RESULTS: Raw data

5. RESULTS: Mean Response

Fig. 3. Across subject mean and within-subject standard error in the no-distractor condition from Exp. 1. B.3 plotted as a function of target speaker (top row) and experimental condition (bottom row). Assumed left-right symmetry - data collapsed across orientation. Outliers lying 23° and more from a within-run median were removed. For each subject, mean response azimuth and standard deviation were calculated.

6. RESULTS: Response Variance (Exp. 2)

7. CONCLUSIONS AND DISCUSSION

A preceding distractor has a complex effect on azimuthal localization of a target click stimulus. This effect is influenced by whether the distractor is likely to be grouped with the target (1-click) or processed in a separate stream (8-click).

EFFECT OF DISTRACTOR (H1)

A 2-click distractor induced 3 types of bias in Kopčo et al. (2007). Here, streaming eliminated 2 of them. Therefore, these biases were not explained by re-ordering processes, reverberation, neural adaptation, or plasticity, top-down effects, or bottom-up effects. This study supports the hypothesis that the effect of a 1-click distractor is likely due to perceptual organization and precedence-likereverberation processing (Freymann et al., 1991).

EFFECT OF CONTEXT (H2)

Contextual bias induced by a 8-click distractor is stronger than that induced by a 1-click distractor, and is larger in a classroom than an anechoic room. This finding is consistent with a bottom-up adaptation mechanism sensitive to the distribution of sources (Main et al., 2011). Therefore, the mechanism underlying the response variance from the stimulus distribution controlled (cf. Demany et al., 2010). It also cannot explain why lateral and frontal distractors have different effects.

Context has an effect on response standard deviation only in the anechoic room, where a lateral-distractor context increases response variance for lateral targets (frontal distractor control). This effect is similar for 1-click and 8-click contexts. A possible per-cue bias-driven mechanism might explain this result. However, it is not clear why a frontal distractor does not lead to an analogous effect for frontal targets.